

WHAT IS CLAIMED IS:

1. A rigid polyurethane foam prepared by mixing:  
an isocyanate;  
a polyol blend comprising
  - 5 about 20% to about 100%, based on the total polyol blend, of  
an aromatic amine-initiated polyether polyol,  
up to about 60%, based on the total polyol blend, of an  
aromatic polyester polyol, and  
up to about 20%, based on the total polyol blend, of a  
10 sucrose-based polyether polyol,  
wherein the sum of the percentages of the polyols totals  
100%; and  
about 10 to about 15%, based on the total foam formulation, of  
1,1,1,3,3-pentafluoropropane (HFC-245fa),  
15 optionally, one or more components chosen from catalysts, chain  
extenders, crosslinking agents, surfactants, foam stabilizers,  
cell regulators, fillers, dyes, pigments, flame retardants,  
hydrolysis protection agents, fungicides and bactericides,  
wherein the rigid polyurethane foam has a k-factor at 35°F of from about  
20 0.115 to about 0.120 BTU-in./hr.ft<sup>2</sup> °F.
2. The rigid polyurethane foam according to Claim 1, wherein the  
polyol blend comprises about 55% of the aromatic amine-initiated  
polyether polyol, about 25% of the aromatic polyester polyol and about  
25 20% of the sucrose-based polyether polyol.
3. The rigid polyurethane foam according to Claim 1, wherein the  
isocyanate is chosen from m-phenylene diisocyanate, p-phenylene  
diisocyanate, 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 1,6-  
30 hexamethylene diisocyanate, 1,4-hexamethylene diisocyanate, 1,4-  
cyclohexane diisocyanate, hexahydrotoluene diisocyanate and isomers

thereof, 1,5-naphthylene diisocyanate, 1-methyl-phenyl-2,4-phenyl diisocyanate, 4,4'-diphenylmethane diisocyanate, 2,4'-diphenyl-methane diisocyanate, 4,4'-biphenylene diisocyanate, 3,3'-dimethoxy-4,4'-biphenylene diisocyanate, 3,3'-dimethyl-diphenyl-propane-4,4'-diisocyanate, 2,4,6-toluene triisocyanate, 4,4'-dimethyl-diphenyl-methane-2,2', 5,5'-tetraisocyanate and polymethylene polyphenylpolyisocyanates.

4. The rigid polyurethane foam according to Claim 1, wherein the isocyanate is a modified polymeric methylenediphenyl diisocyanate (pMDI).

5. The rigid polyurethane foam according to Claim 1, wherein the foam formulation further includes from about 0.1% to about 1.5%, based on the total foam formulation of water.

6. The rigid polyurethane foam according to Claim 1, wherein the aromatic amine-initiated polyol is based on ortho-toluene diamine (o-TDA).

7. The rigid polyurethane foam according to Claim 1, wherein the foam formulation comprises about 12.5%, based on the total foam formulation, of the 1,1,1,3,3-pentafluoropropane (HFC-245fa).

8. In a process of making an appliance insulation material, the improvement comprising including the rigid polyurethane foam according to Claim 1.

9. A rigid polyurethane foam prepared by mixing:  
an isocyanate;  
a polyol blend comprising  
about 20% to about 90%, based on the total polyol blend, of  
the aromatic amine-initiated polyether polyol,

about 5% to about 60%, based on the total polyol blend, of  
the aromatic polyester polyol, and  
about 5% to about 20%, based on the total polyol blend, of  
the sucrose-based polyether polyol,  
5 wherein the sum of the percentages of the polyols totals  
100%; and  
about 10 to about 15%, based on the total foam formulation, of  
1,1,1,3,3-pentafluoropropane (HFC-245fa),  
optionally, one or more components chosen from catalysts, chain  
10 extenders, crosslinking agents, surfactants, foam stabilizers,  
cell regulators, fillers, dyes, pigments, flame retardants,  
hydrolysis protection agents, fungicides and bactericides,  
wherein the rigid polyurethane foam has a k-factor at 35°F of from about  
0.115 to about 0.120 BTU-in./hr.ft<sup>2</sup> °F.

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10. The rigid polyurethane foam according to Claim 9, wherein the  
polyol blend comprises about 55% of the aromatic amine-initiated  
polyether polyol, about 25% of the aromatic polyester polyol and about  
20% of the sucrose-based polyether polyol.

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11. The rigid polyurethane foam according to Claim 9, wherein the  
isocyanate is chosen from m-phenylene diisocyanate, p-phenylene  
diisocyanate, 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 1,6-  
hexamethylene diisocyanate, 1,4-hexamethylene diisocyanate, 1,4-  
25 cyclohexane diisocyanate, hexahydrotoluene diisocyanate and isomers  
thereof, 1,5-naphthylene diisocyanate, 1-methyl-phenyl-2,4-phenyl  
diisocyanate, 4,4'-diphenylmethane diisocyanate, 2,4'-diphenyl-methane  
diisocyanate, 4,4'-biphenylene diisocyanate, 3,3'-dimethoxy-4,4'-  
biphenylene diisocyanate, 3,3'-dimethyl-diphenyl-propane-4,4'-  
30 diisocyanate, 2,4,6-toluene triisocyanate, 4,4'-dimethyl-diphenyl-methane-  
2,2', 5,5'-tetraisocyanate and polymethylene polyphenylpolyisocyanates.

12. The rigid polyurethane foam according to Claim 9, wherein the isocyanate is a modified polymeric methylenediphenyl diisocyanate (pMDI).

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13. The rigid polyurethane foam according to Claim 9, wherein the foam formulation further includes from about 0.1% to about 1.5%, based on the total foam formulation of water.

10 14. The rigid polyurethane foam according to Claim 9, wherein the aromatic amine-initiated polyol is based on ortho-toluene diamine (o-TDA).

15 15. The rigid polyurethane foam according to Claim 9, wherein the foam formulation comprises about 12.5%, based on the total foam formulation, of the 1,1,1,3,3-pentafluoropropane (HFC-245fa).

16. In a process of making an appliance insulation material, the improvement comprising including the rigid polyurethane foam according to Claim 9.

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17. A rigid polyurethane foam prepared by mixing:  
an isocyanate;  
a polyol blend comprising

25 about 40% to about 90%, based on the total polyol blend, of  
an aromatic amine-initiated polyether polyol,  
about 60% to about 10%, based on the total polyol blend, of  
an aromatic polyester polyol, and

wherein the sum of the percentages of the polyols totals  
100%; and  
30 about 10 to about 15%, based on the total foam formulation, of  
1,1,1,3,3-pentafluoropropane (HFC-245fa),

- optionally, one or more components chosen from catalysts, chain extenders, crosslinking agents, surfactants, foam stabilizers, cell regulators, fillers, dyes, pigments, flame retardants, hydrolysis protection agents, fungicides and bactericides,
- 5 wherein the rigid polyurethane foam has a k-factor at 35°F of from about 0.115 to about 0.120 BTU-in./hr.ft<sup>2</sup> °F.

18. The rigid polyurethane foam according to Claim 17, wherein the isocyanate is chosen from m-phenylene diisocyanate, p-phenylene  
10 diisocyanate, 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 1,6-hexamethylene diisocyanate, 1,4-hexamethylene diisocyanate, 1,4-cyclohexane diisocyanate, hexahydrotoluene diisocyanate and isomers thereof, 1,5-naphthylene diisocyanate, 1-methyl-phenyl-2,4-phenyl  
diisocyanate, 4,4'-diphenylmethane diisocyanate, 2,4'-diphenyl-methane  
15 diisocyanate, 4,4'-biphenylene diisocyanate, 3,3'-dimethoxy-4,4'-biphenylene diisocyanate, 3,3'-dimethyl-diphenyl-propane-4,4'-diisocyanate, 2,4,6-toluene triisocyanate, 4,4'-dimethyl-diphenyl-methane-2,2', 5,5'-tetraisocyanate and polymethylene polyphenylpolyisocyanates.

20 19. The rigid polyurethane foam according to Claim 17, wherein the isocyanate is a modified polymeric methylenediphenyl diisocyanate (pMDI).

20. The rigid polyurethane foam according to Claim 17, wherein the  
25 foam formulation further includes from about 0.1% to about 1.5%, based on the total foam formulation, of water.

21. The rigid polyurethane foam according to Claim 17, wherein the aromatic amine-initiated polyol is based on ortho-toluene diamine (o-TDA).

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22. The rigid polyurethane foam according to Claim 17, wherein the polyol blend further includes up to about 20%, based on the total polyol blend, of a sucrose-based polyether polyol.

5 23. The rigid polyurethane foam according to Claim 17, wherein the foam formulation comprises about 12.5%, based on the total foam formulation, of the 1,1,1,3,3-pentafluoropropane (HFC-245fa).

10 24. In a process of making an appliance insulation material, the improvement comprising including the rigid polyurethane foam according to Claim 17.

15 25. A process for making a rigid polyurethane foam comprising mixing:  
an isocyanate;  
a polyol blend comprising  
about 20% to about 100%, based on the total polyol blend, of  
an aromatic amine-initiated polyether polyol,  
up to about 60%, based on the total polyol blend, of an  
aromatic polyester polyol, and  
20 up to about 20%, based on the total polyol blend, of a  
sucrose-based polyether polyol,  
wherein the sum of the percentages of the polyols totals  
100%; and  
about 10 to about 15%, based on the total foam formulation, of  
25 1,1,1,3,3-pentafluoropropane (HFC-245fa),  
optionally, one or more components chosen from chain extenders,  
crosslinking agents, surfactants, foam stabilizers, cell  
regulators, fillers, dyes, pigments, flame retardants,  
hydrolysis protection agents, fungicides and bactericides,  
30 optionally in the presence of a catalyst,

wherein the rigid polyurethane foam has a k-factor at 35°F of from about 0.115 to about 0.120 BTU-in./hr.ft<sup>2</sup> °F.

26. The process according to Claim 25, wherein the polyol blend  
5 comprises about 55 % of the aromatic amine-initiated polyether polyol,  
about 25% of the aromatic polyester polyol and about 20% of the sucrose-  
based polyether polyol.
27. The process according to Claim 25, wherein the isocyanate is  
10 chosen from m-phenylene diisocyanate, p-phenylene diisocyanate, 2,4-  
toluene diisocyanate, 2,6-toluene diisocyanate, 1,6-hexamethylene  
diisocyanate, 1,4-hexamethylene diisocyanate, 1,4-cyclohexane  
diisocyanate, hexahydrotoluene diisocyanate and isomers thereof, 1,5-  
naphthylene diisocyanate, 1-methyl-phenyl-2,4-phenyl diisocyanate, 4,4'-  
15 diphenylmethane diisocyanate, 2,4'-diphenyl-methane diisocyanate, 4,4'-  
biphenylene diisocyanate, 3,3'-dimethoxy-4,4'-biphenylene diisocyanate,  
3,3'-dimethyl-diphenyl-propane-4,4'-diisocyanate, 2,4,6-toluene  
triisocyanate, 4,4'-dimethyl-diphenyl-methane-2,2', 5,5'-tetraisocyanate  
and polymethylene polyphenylpolyisocyanates.  
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28. The process according to Claim 25, wherein the isocyanate is a  
modified polymeric methylenediphenyl diisocyanate (pMDI).
29. The process according to Claim 25, wherein from about 0.1% to  
25 about 1.5%, based on the total foam formulation, of water is included.
30. The process according to Claim 25, wherein the aromatic amine-  
initiated polyol is based on ortho-toluene diamine (o-TDA).

31. The process according to Claim 25, wherein the foam formulation comprises about 12.5 %, based on the total foam formulation, of the 1,1,1,3,3-pentafluoropropane (HFC-245fa).

5 32. In a process of making an appliance insulation material, the improvement comprising including the rigid polyurethane foam made by the process according to Claim 25.

10 33. A process for making a rigid polyurethane foam comprising mixing:  
an isocyanate;  
a polyol blend comprising  
about 20% to about 90%, based on the total polyol blend, of  
the aromatic amine-initiated polyether polyol,  
about 5% to about 60%, based on the total polyol blend, of  
15 the aromatic polyester polyol, and  
about 5% to about 20%, based on the total polyol blend, of  
the sucrose-based polyether polyol,  
wherein the sum of the percentages of the polyols totals  
100%; and  
20 about 10 to about 15%, based on the total foam formulation, of  
1,1,1,3,3-pentafluoropropane (HFC-245fa),  
optionally, one or more components chosen from chain extenders,  
crosslinking agents, surfactants, foam stabilizers, cell  
regulators, fillers, dyes, pigments, flame retardants,  
25 hydrolysis protection agents, fungicides and bactericides,  
optionally in the presence of a catalyst,  
wherein the rigid polyurethane foam has a k-factor at 35°F of from about  
0.115 to about 0.120 BTU-in./hr.ft<sup>2</sup> °F.

30 34. The process according to Claim 33, wherein the polyol blend comprises about 55% of the aromatic amine-initiated polyether polyol,



about 25% of the aromatic polyester polyol and about 20% of the sucrose-based polyether polyol.

35. The process according to Claim 33, wherein the isocyanate is  
5 chosen from m-phenylene diisocyanate, p-phenylene diisocyanate, 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 1,6-hexamethylene diisocyanate, 1,4-hexamethylene diisocyanate, 1,4-cyclohexane diisocyanate, hexahydrotoluene diisocyanate and isomers thereof, 1,5-naphthylene diisocyanate, 1-methyl-phenyl-2,4-phenyl diisocyanate, 4,4'-  
10 diphenylmethane diisocyanate, 2,4'-diphenyl-methane diisocyanate, 4,4'-biphenylene diisocyanate, 3,3'-dimethoxy-4,4'-biphenylene diisocyanate, 3,3'-dimethyl-diphenyl-propane-4,4'-diisocyanate, 2,4,6-toluene triisocyanate, 4,4'-dimethyl-diphenyl-methane-2,2', 5,5'-tetraisocyanate and polymethylene polyphenylpolyisocyanates.

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36. The process according to Claim 33, wherein the isocyanate is a modified polymeric methylenediphenyl diisocyanate (pMDI).

37. The process according to Claim 33, wherein from about 0.1% to  
20 about 1.5%, based on the total foam formulation, of water is included.

38. The process according to Claim 33, wherein the aromatic amine-initiated polyol is based on ortho-toluene diamine (o-TDA).

25 39. The process according to Claim 33, wherein the foam formulation comprises about 12.5%, based on the total foam formulation, of the 1,1,1,3,3-pentafluoropropane (HFC-245fa).

40. In a process of making an appliance insulation material, the  
30 improvement comprising including the rigid polyurethane foam made by the process according to Claim 33.

41. A process for making a rigid polyurethane foam comprising mixing:  
an isocyanate;  
a polyol blend comprising  
5 about 40% to about 90%, based on the total foam  
formulation, of an aromatic amine-initiated polyether  
polyol,  
about 60% to about 10%, based on the total foam  
formulation, of an aromatic polyester polyol, and  
10 wherein the sum of the percentages of the polyols totals  
100%; and  
about 10 to about 15%, based on the total foam formulation, of  
1,1,1,3,3-pentafluoropropane (HFC-245fa),  
optionally, one or more components chosen from catalysts, chain  
15 extenders, crosslinking agents, surfactants, foam stabilizers,  
cell regulators, fillers, dyes, pigments, flame retardants,  
hydrolysis protection agents, fungicides and bactericides,  
wherein the rigid polyurethane foam has a k-factor at 35°F of from about  
0.115 to about 0.120 BTU-in./hr.ft<sup>2</sup> °F.  
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42. The process according to Claim 41, wherein the isocyanate is  
chosen from m-phenylene diisocyanate, p-phenylene diisocyanate, 2,4-  
toluene diisocyanate, 2,6-toluene diisocyanate, 1,6-hexamethylene  
diisocyanate, 1,4-hexamethylene diisocyanate, 1,4-cyclohexane  
25 diisocyanate, hexahydrotoluene diisocyanate and isomers thereof, 1,5-  
naphthylene diisocyanate, 1-methyl-phenyl-2,4-phenyl diisocyanate, 4,4'-  
diphenylmethane diisocyanate, 2,4'-diphenyl-methane diisocyanate, 4,4'-  
biphenylene diisocyanate, 3,3'-dimethoxy-4,4'-biphenylene diisocyanate,  
3,3'-dimethyl-diphenyl-propane-4,4'-diisocyanate, 2,4,6-toluene  
30 triisocyanate, 4,4'-dimethyl-diphenyl-methane-2,2', 5,5'-tetraisocyanate  
and polymethylene polyphenylpolyisocyanates.

43. The process according to Claim 41, wherein the isocyanate is a modified polymeric methylenediphenyl diisocyanate (pMDI).
- 5 44. The process according to Claim 41, wherein from about 0.1% to about 1.5%, based on the total foam formulation, of water is included.
45. The process according to Claim 41, wherein the aromatic amine-initiated polyol is based on ortho-toluene diamine (o-TDA).
- 10 46. The process according to Claim 41, wherein the foam formulation comprises about 12.5%, based on the total foam formulation, of the 1,1,1,3,3-pentafluoropropane (HFC-245fa).
- 15 47. The process according to Claim 41, wherein the polyol blend further includes up to about 20%, based on the total foam formulation, of a sucrose-based polyether polyol.
- 20 48. In a process of making an appliance insulation material, the improvement comprising including the rigid polyurethane foam made by the process according to Claim 41.